



Information Science and Technology Center Seminar



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“On a Sturm-Liouville Framework for Continuous and Discrete Frequency Modulation”

Monday, February 22, 2010
10:00 - 11:30 AM

TA-3, Bldg. 1690, Room 102 (CNLS Conference Room)

Abstract: A significant part of the body of research in signal processing and many related areas relies on sinusoidal modeling, stationary assumptions over windowed signal segments. In fact, LTI system theory has its roots in sinusoidal signals being eigenfunctions of the convolution operator. However, many examples of real-world signals such as human speech, ECG, MEG waveforms are non-stationary in terms of their frequency content. The conventional approach to modeling of these signals has been to assume a stationary or sinusoidal signal model over windowed portions of the signal of interest.

The goal of this talk is to introduce a framework for the analysis of frequency modulated signals from the perspective of *Sturm-Liouville* (S-L) differential and difference equations. The motivation for this specific approach is two-fold: (a) to obtain orthogonal modes of FM modulation and (b) to enable development of system theory that is applicable to frequency modulated waveforms. In the process, we will explore the connection between the S-L framework and another set of orthogonal frequency and amplitude modulated waveforms, the FAM-lets.

Simulation results that depict the orthogonal modes of frequency modulation for various forms of instantaneous frequency, separation of FM modes and orthogonal FM modes in noise will be described.

Biography: Balu Santhanam is currently an associate professor of Electrical and Computer Engineering at the University of New Mexico, Albuquerque. Some of his recent projects have been in the areas of non-stationary signal modeling, AM—FM signal modeling and analysis, time-frequency representations for non-stationary signal environments, hybrid ICA-SVM systems for modulation recognition and engine type classification, areal image enhancement for optical nanolithography, and Fractional Fourier transform based vibrometry using SAR. He is the recipient of 2000 and 2005, ECE best teacher award, is currently the chair of the Albuquerque joint signal processing and communications chapter of the IEEE, and also a senior member of the IEEE.



Contact the technical host Don Hush, dhush@lanl.gov, 665-2722 or the institutional host Frank Alexander, fja@lanl.gov, 665-4518 for further information.

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